
INVITED CLINICAL COMMENTARY REHABILITATION FOLLOWING HIP ARTHROSCOPY: AN EVOLVING PROCESS

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ABSTRACT

The utilization of hip arthroscopy to treat non-arthritic pain in athletes continues to grow in popularity. Though numerous protocols have been described in the literature, there is no current evidence-based consensus regarding the postoperative management of patients undergoing hip arthroscopy. Intraoperative findings determine the specific surgical procedure and subsequently play a role in postoperative rehabilitation. Current protocols are primarily based on tissue healing properties, patient tolerance, and clinician experience. General recommendations regarding range-of-motion initiation, weight bearing progression, and strength activities exist. Though relatively uncommon, postoperative complications have been described. Clinicians should be aware of factors, both surgical and rehabilitation-related, that may affect a patient's postoperative progression. In order to assess patients' postoperative improvement, clinicians must utilize outcome measures that effectively assess the functional status level of active individuals following hip arthroscopy. The development of criteria-based programs may improve the consistency of rehabilitation and potentially aid in providing patients a safe, efficient return to athletics.

Key Words: Hip, acetabular labrum, rehabilitation

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INTRODUCTION

Surgical options for patients experiencing non-arthritic hip pain have evolved significantly in recent times. The advancement in diagnostic techniques and surgical instrumentation have allowed the utilization of arthroscopy to address intra-articular pathology that was previously not addressable or would require techniques that were too invasive for younger, active individuals with non-arthritic hip pathology. Conditions that can be addressed by arthroscopy include: acetabular labral tears, femoral acetabular impingement (FAI), capsular laxity, chondral lesions, and intra-articular loose bodies.¹ Early in the procedure's history, debridement of the torn labrum was the most common procedure performed.² While this still holds true, surgical options have expanded to include osteoplasty of the femoral neck and/or acetabulum to address FAI, capsular modification to address laxity, and complex repairs or reconstruction of the acetabular labrum. The benefits of hip arthroscopy have been most evident in the active patient population.

With the growing utilization of hip arthroscopy, postoperative rehabilitation protocols must evolve as well. Traditionally, postoperative protocols for surgical procedures addressing the hip joint have focused on procedures commonly performed on the older population. Such procedures include total hip arthroplasty (THA) and open-reduction-internal-fixation (ORIF) for fractures of the proximal femoral neck or pelvis. These protocols often do not address the needs of the more active population undergoing hip arthroscopy procedures.² Current postoperative rehabilitation protocols for hip arthroscopy patients must utilize rehabilitation strategies that account for and prepare the patient for return to the strenuous demands that will be placed upon the joint once physical activity is resumed by the patient.

Current postoperative rehabilitation protocols used for rehabilitation following arthroscopic hip procedures lack objective evaluation. The literature describing rehabilitation following hip arthroscopy, for the most part, is limited to clinical commentaries and case series.²⁻¹² Though positive surgical outcomes have generally been reported in the literature,¹ the effects of variation in postoperative rehabilitation protocols has not been studied. In order to optimize outcomes after hip arthroscopy, the optimal

approach to postoperative rehabilitation should be determined.

CURRENT PROTOCOLS

As previously stated, current post-hip arthroscopy rehabilitation protocols for the hip joint vary between surgeons and surgical centers.²⁻¹² Despite variations and inconsistencies that occur, there are principles commonly utilized in the majority of protocols. A general overview of these principles will be discussed.

RANGE OF MOTION AND MOBILITY

Early range-of-motion (ROM) is typically indicated following hip arthroscopy. The immediate goal is to prevent postoperative joint stiffness and avoid potential postoperative intra-articular adhesions. Pendulum or circumduction ROM exercises are commonly recommended in the early postoperative period in order to reduce the risk of intra-articular adhesion formation (Figure 1). Willimon et al reported that a rehabilita-



Figure 1. Circumduction range-of-motion being performed to minimize capsular adhesion following hip arthroscopy.

tion program including circumduction exercises performed multiple times per day significantly reduces the revision arthroscopy rate.¹³ ROM is usually performed in a pain free range. The stationary bike is often utilized for repetitive ROM in the sagittal plane. Continuous passive range of motion (CPM) machines may be prescribed post operatively for sagittal plane ROM, but are not universally recommended. Early flexion may be achieved using a quadruped rocking exercise (Figure 2). Obtaining flexion in this manner allows the patient to control the range-of-motion while partially loading the joint. The length of time and parameters for progression of ROM vary between protocols and by the specific surgical procedures performed.¹³ When procedures are performed to address capsular laxity, ROM precautions may be enacted to protect the affected tissue. External rotation and extension are limited for a period of time when procedures affecting the anterior capsule and iliofemoral ligament are performed. Flexion and internal rotation are limited in cases where the posterior capsule was surgically addressed. A postoperative ROM brace is commonly utilized, though the indications and length of time for use is not universally agreed upon. This brace may be adjusted to varying degrees of extension and flexion when placing tension across the joint capsule is a postoperative concern.

WEIGHT BEARING CONSIDERATIONS

Weight bearing precautions are variable depending upon procedure. In minimally invasive cases such as isolated labral debridement, there is typically a short period of partial weight bearing, often two weeks or less. The protected weight bearing stage may be prolonged in cases where the cartilage (microfracture)

or bone (osteoplasty) has been addressed. Extensive repairs of the acetabular labrum may require a longer period of protected weight bearing as well. In these more involved cases, the partial weight bearing may be extended for up to six weeks. A non-weight bearing gait pattern is not typically recommended for patients unless the surgical procedure necessitates significant protection of the affected osseous or chondral structures. Maintaining non-weight bearing position of the involved leg produces increased compressive forces across the hip joint due to activation of the hip flexors.¹⁴ Axillary crutches are typically the assistive device of choice. Even with minimal postoperative swelling and pain there may be significant reflex inhibition of the gluteus medius leading to poor muscle function and compensatory movement patterns such as the inability to maintain pelvic stability in the frontal plane during ambulation.¹¹ Clinically, when a patient presents with significant gluteus medius weakness or inhibition a contralateral pelvic drop will be seen while the uninvolved limb becomes unsupported during the swing phase and the person assumes a single leg stance position on involved lower extremity.¹⁵ Crutches are typically recommended to prevent this pelvic drop allowing patients to ambulate with a more normalized muscle activation and gait pattern. Allowing patients to continue ambulation with compensation patterns may lead to continued intra-articular irritation and/or overuse of accessory musculature surrounding the hip potentially delaying recovery.^{6,16} It is recommended that patients remain on crutches until they are able to ambulate without any deviations, even if this persists beyond timeframes stated in post operative guidelines.

MUSCULAR STRENGTHENING EXERCISES

Postoperative strengthening exercise recommendations vary widely among protocols and/or clinicians. Selected interventions should be dictated by the patient's ROM and weight bearing tolerance ensuring adequate range of motion and neuromuscular control allowing completion of exercises without reinforcing abnormal patterns or increasing pain and inflammation. In cases where the iliopsoas or iliotibial band (ITB) structures have been released or lengthened, exercises that specifically stress these tissues may be delayed to allow tissue healing.



Figure 2. Early flexion of the hip joint being performed in the quadruped position.

Initially submaximal isometrics at thigh, pelvis, and trunk should be prescribed to limit muscular atrophy. Malloy et al recommended focusing on the transversus abdominus and multifidus for lumbar spine stability with transfers.¹⁶ Gluteal, quad, and iliopsoas isometrics performed in prone position are recommended to promote neutral hip position and limit anterior soft tissue tightness.^{12,16} As the patient progresses, more emphasis is placed on gluteal muscle strengthening especially the gluteus medius and hip abductors due to their role of frontal plane stability of the pelvis in functional activities such as gait.¹⁶ Although there is minimal research available that examines muscle functioning patterns in the non-arthritic hip pain population, literature describing muscle activation patterns during specific exercises in the healthy population does exist.¹⁷ Protocols should be developed considering this knowledge, with a future goal of utilizing data regarding the pathological and postoperative population as it becomes available. Figure 3 shows the progression of external rotator strengthening. The individual begins with partially loaded, band-resisted, external rotation using a stool. Once the patient can maintain stability in the frontal plane (appropriate hip abductor strength), they can initiate resisted hip external rotator strengthening in a full-weight bearing position.



Figure 3. Resisted external rotation being performed in partial and full-weight bearing.

COMMON POSTOPERATIVE COMPLICATIONS AND FACTORS AFFECTING PROGRESSION

Hip arthroscopy is being used on a regular basis for management of FAI and a variety of intra-articular pathologies. Larson and Giveans reported good to excellent results in 75% of patients at a one year follow up for patients with FAI who were managed with arthroscopy.¹⁸ Hip arthroscopy has been reported to be a relatively safe procedure with complication rates reported around 1.5%. Despite the low reported rate, numerous complications have been described. As with any surgical procedure, complications due to deep venous thrombosis, infection, neurovascular injury, and bleeding are possible.¹⁹ Complications specific to hip arthroscopy can include traction related injuries of the neurovascular structures, fluid extravasation, avascular necrosis, cartilage injury, over or under resection of the underlying pathology, development of heterotopic ossification, and/or the formation of intra-articular adhesions.^{13,19}

Clinicians involved in the post operative management of patients who have undergone hip arthroscopy should be aware of potential complications, how these complications would present clinically, and/or be able to recognize atypical or poor progression after surgery. Prompt communication and/or referral with the surgeon is recommended if complications are suspected or if a patient is unable to progress as expected. Traction related injuries are the most commonly reported complication due to arthroscopy. The majority of these complications are neuropraxias believed to be due to prolonged time under traction.¹⁹ The pudendal nerve is most commonly reported with the sciatic nerve being the second most commonly involved structure. The majority of neuropraxias resolve with time, not requiring further intervention.²⁰

Beyond potential surgical complications and formation of postoperative adhesions, many causes for delayed recovery may be preventable with a more attentive progression of interventions. Often, complications are due to an over-aggressive rehabilitation approach. For example, interventions prescribed at a higher intensity than the patient's strength and neuromuscular control level can manage, resulting in an inappropriate dosage of exercise activity. Progression of exercises within the postoperative guidelines should

focus on criteria-based measures, not only time-based milestones. Time-based guidelines are provided initially to allow for protection and healing of involved structures. As the patient progresses from the early or immediate postoperative period the therapist should base progression decisions on the patient's ability to demonstrate mastery of all exercises at the current level with the appropriate ROM, stability/control, and proprioception.⁹ Progression of intensity or volume prematurely can cause increased inflammation, pain, and delayed recovery.

Some potential complications during the early rehabilitation period include intra and extra-articular soft tissue irritation due to poor instruction or lack of adherence to foot flat weight bearing pattern immediately after surgery. Non-weight bearing or toe touch weight bearing which promotes consistent activation of the hip flexor muscles, may produce excessive forces at the anterior hip joint if the musculature is weak after surgery.^{14,16} Excessive compressive forces may be produced at the involved hip joint if patients begin active or loaded movements and/or exercises without appropriate strength and frontal plane stability at hip and pelvis.^{16,21}

Increased intra and extra-articular hip irritation may occur as patients return to prolonged or community ambulation if they lack sufficient strength and muscular endurance required for the demands of the task.^{6,16} Progression toward more advanced neuromuscular re-education and single leg strengthening exercises with progressive loading such as step-up exercises and lunge variations should be delayed until patient reports pain free community ambulation.¹⁶ As the rehabilitation program progresses to include single leg strengthening it is important that the individual's neuromuscular control is reestablished and that these individuals possess adequate pelvic and trunk control to prevent any compensations which could lead to irritation or injury.^{16,22}

A significant factor that often results in revision arthroscopy is under or over resection of the underlying CAM or pincer deformities.^{19,23} Philippon et al reported that under resection and persisting impingement was present in 36 out of 37 patients who presented to their center for revision procedures.²⁴ Over resection can potentially lead to femoral neck stress fractures or instability.^{19,25} Due to the difficulty of

clinically diagnosing these issues, clinicians involved in caring for postoperative patients should have an understanding of the expected response to activity and typical progression. The expected time frame to achieve full weight bearing, independent ambulation, and return to higher-level activities such as jogging should be considered. Those who are unable to progress should be promptly referred to the surgeon for further assessment and a more thorough evaluation.

Intra-articular hip adhesions have more recently been reported as a significant cause of post operative pain and failure after hip arthroscopy or open procedures to address FAI.^{13,23,26,27} Willimon et al reported that risk factors associated with development of post operative adhesions included patients less than 30 years of age, a modified Harris Hip score below 50, no microfracture procedure performed, and a rehabilitation protocol which did not include circumduction exercises.¹³ Their study demonstrates the importance of including circumduction exercises and that the post operative protocol can directly affect the patient's outcome. The patient and the patient's caregivers should be educated on the importance of compliance with the home exercise program and the increased risk of suboptimal outcome that is possible from not adhering to the post operative recommendations.

RECOGNITION OF CONCURRENT CONDITIONS

The differential diagnosis of hip and groin pain in active individuals and athletes is challenging due to the nature of overlapping symptoms and frequent coexisting conditions.²⁸ If patients participate in formal physical therapy preoperatively, the evaluating clinician should perform a thorough examination identifying possible conditions as well as any impairments or risk factors that could predispose the individual to injury. Following surgery it is important that the therapist addresses any asymmetries or imbalances that would increase risk for re-injury prior to allowing the athlete to return to sport. When FAI is present, the resulting restricted ROM during high intensity repetitive movement required in many sports may result in excessive stress or strain and injury to soft tissue structures around the hip.²⁹ One such secondary condition is athletic pubalgia or sports hernia. Hamoud et al reported a high incidence of sports hernia

symptoms in athletes with FAI.²⁹ Pelvic floor region dysfunction, such as obturator nerve entrapment, may also present as exertional groin pain.³⁰ Clinicians should recognize the potential for concurrent athletic pubalgia and/or pelvic floor dysfunction in patients who have undergone hip arthroscopy.

Athletes undergoing hip arthroscopy may have a history of previous injury. Though surgery may address the athlete's primary issue of intra-articular injury, previous issues that resolved or perhaps were not addressed in the past, may become relevant. If not recognized and addressed, these issues may not allow the athlete to fully progress back to their desired level of activity. Conditions that should be considered are hip and pelvic bursitis, tendinopathy (hamstring, piriformis, adductor, and iliopsoas), osteitis pubis, and sacroiliac dysfunction.

OUTCOME MEASURES

The typical activity demands and patients' post-operative expectations after hip arthroscopy necessitate the utilization of patient reported outcome measures that capture the appropriate level of functioning. Measurement tools that have been commonly used with other surgical procedures of the hip (THA and ORIF), or conservative treatment of hip osteoarthritis may over-estimate clinical improvement. Such self-reported measurement tools include the Harris Hip Score and the Western Ontario and McMaster Arthritis Scale (WOMAC).³¹

More recently, patient reported outcomes have been developed and validated in the younger population of patients with hip pathology, including those that have undergone arthroscopic surgery. The Hip Outcome Score (HOS) was developed to measure activity and performance in the non-arthritic hip pathology population.³² The HOS contains a 17-item activities of daily living (ADL) and a 9-item sports subscale. Items are scored from 0 (unable to do) to 4 (no difficulty). The total number of items is then multiplied by 4 to calculate the highest possible score. The patient's score is divided by the highest possible score and multiplied by 100 to produce a percentage score. Minimal clinically important difference values have been reported as 9 points for the ADL subscale and 6 points for the sports subscale.³² The HOS has shown reliability, and has demonstrated content and construct validity for

use in the hip arthroscopy population.³² The sport subscale may be particularly useful for patients undergoing hip arthroscopy, as many of these individuals wish to return to athletic activity.

The International Hip Outcome Tool (iHOT-33) was developed to assess the quality of life in young, active patients with pathological hip conditions.³³ The iHOT-33 is a 33-item questionnaire that captures subjective reports of symptoms with physical activity, sports or recreation activity concerns, and job-related concerns, and social, emotional, or lifestyle concerns. The questionnaire uses a visual analog scale. The iHOT-33 has been shown to be reliable, demonstrates face content, and construct validity.³³ An abridged version of the original iHOT-33 is available. The iHOT-12 contains 12 questions, and has shown excellent agreement with its lengthier predecessor.³⁴

The Copenhagen Hip and Groin Outcome Score (HAGOS) was developed to assess young to middle-aged, physically active patients with longstanding hip and/or groin pain.³⁵ The HAGOS contains 35 items divided among six subscales for Pain, Symptoms, Physical function in daily living, Physical function in Sport and Recreation, Participation in Physical Activities, and hip and/or groin-related Quality of Life. Each item is scored 0 (optimal) – 4 (most affected by the condition). A normalized score is calculated for each subscale, with 100 being the optimal score. The HAGOS has shown strong evidence for content validity, test-retest reliability and responsiveness.^{35,36}

CRITERIA-BASED PROGRESSION

Few descriptions of post-operative functional progressions based upon clinical milestones exist in the current literature. Existing descriptions of functional progression in postoperative protocols are based upon author experience and/or preference or modifications of protocols utilized after other surgical procedures.¹ The development of protocols that base progression upon performance on performance on functional tests validated in the hip arthroscopy population is an objective that should be prioritized.

Presently, few functional tests have been validated for patients following hip arthroscopy. Kivlan and Martin conducted a literature review to examine functional tests that may be applicable for use with young,



Figure 4. *Sport-specific exercises for rehabilitation of ice hockey players.*

active individuals with non-arthritic hip pain.³⁶ Of the tests examined, only the deep squat and single-leg balance tests have shown validity in the population of patients with non-arthritic hip pathology. It is important to note, these tests were not examined specifically in the postoperative population. The authors suggested normative data from the younger, more active population that has been established for the Functional Movement Screen (FMS™) may help clinicians identify abnormal results in patients with hip pathology.³⁶ The Star Excursion Balance Test (SEBT) has been shown to be affected by variations in hip joint kinematics and muscle function.³⁷ The performance of patients on this test following hip arthroscopy may be a future subject of study.

Currently, there is no standardized testing procedure described in the literature used to determine an athlete's readiness to return to sport following hip arthroscopy. However, there are numerous case reports and case series that describe sport-specific rehabilitation for patients undergoing hip arthroscopy. These include athletes participating in soccer,^{3,38} ice-hockey,³⁹ and American football.^{4,40} Figure 4 displays sport specific rehabilitation activities for ice hockey players. Such descriptions of treatment may be the initial steps in developing criteria-based rehabilitation protocols for athletes undergoing hip arthroscopy as they provide an idea of the demands the patient is expected to endure as they progress towards returning to sport.

CONCLUSION

Hip arthroscopy has been one of the fastest growing orthopaedic surgical procedures of the last decade. As

the procedure evolves, the associated postoperative rehabilitation process must also be researched and standardized to meet the often-strenuous demands and expectations of this patient population. The number of postoperative protocols described in the literature continues to grow, yet the published evidence to support the interventions described is relatively weak when compared to more established arthroscopic procedures such as those performed to address pathologies of the knee and shoulder. While the current protocols have provided a solid theoretical foundation upon which to base rehabilitation, these suggestions must be substantiated by research directed specifically towards the hip arthroscopy population. Postoperative complications and factors that may hinder functional progression have been recognized and should be considered as future protocols are being developed. Protocol effectiveness should be assessed using patient reported outcome instruments (HOS, iHOT-33/iHOT-12, HAGOS) that are appropriate for the relatively young, active population of patients that typically undergoes hip arthroscopy. Finally, protocols should provide progression recommendations based upon achieving satisfactory performance on appropriate functional tests, ensuring that rehabilitation is individualized yet consistent in delivery.

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